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(54) ELECTROSTRICTIVE EFFECT ELEMENT

(57)Abstract:

PURPOSE: To prevent electrical insulation deterioration and thermal stress during process by reducing man-hour which is required for forming a glass insulation layer constituting an electrostrictive effect element.

CONSTITUTION: In a lamination-type electrostrictive effect element where a piezoelectric ceramic member and an inner electrode conductor layer are laminated alternately, press conductive films 2e1 and 2e2 are provided on a pair of opposing side surfaces of the electrostrictive effect element, a press conductive film is pressed and connected by external electrode conductors 5c1 and 5c2 to an internal electrode exposed end face at every other layer and alternately on each side surface. Since there is no process for forming the glass insulation layer, causes leading to insulation deterioration such as diffusion of silver into glass on formation of external electrode conductor layer conventionally and generation of crack within glass due to thermal stress can be eliminated, thus improving reliability of the insulation layer and preventing deterioration of the element and at the same time reducing a process and hence man-hour.

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CLAIMS

[Claim(s)]

[Claim 1]The electrostrictive effect component characterized by having a pressurization conductivity film on the side face of the pair which said electrostrictive effect component counters in the laminating mold electrostrictive effect component which carried out the laminating of a piezo-electric ceramic member and the internal electrode conductor layer by turns, and moreover making pressurization connection of said pressurization conductivity film alternately on each side face setting further on said internal electrode outcrop end face.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates especially to the structure of an external electrode about the electrostrictive effect component used for an electrostrictive actuator.

[0002]

[Description of the Prior Art]Conventionally, as shown in drawing 4, after this kind of electrostrictive effect component mixes and green-sheet-izes an organic binder to outside component solid-solution ceramic powder with a perovskite crystal structure and applies the silver electrode conductor layer 4 in the shape of a paste on it, it obtains the sintered compact which carried out dozens of layer (for example, 64 layers) laminating, and carried out the laminating of the piezo-electric ceramic member 3 and the silver electrode conductor layer 4. Insulating processing is carried out setting the edge of the silver electrode conductor layer 4 further in one side face, in order that the edge of the silver electrode conductor layer 4 may carry out all layer exposure and may form a sinking comb form internal electrode in the side face of this sintered compact, and it is the glass insulating layer 712. It forms, it sets on the side face of another side, and is the glass insulating layer 712. It forms. And the band-like external electrode conductor layer 5 is formed in each side face so that it may connect by turns for setting the silver electrode conductor layer 4 further, and it is 1 and 6d2 6d of lead wire to this. It soldered and the electrostrictive effect component 110 had been obtained.

[0003]

[Problem(s) to be Solved by the Invention]The conventional electrostrictive effect component mentioned above prints and calcinates the conductive paste of a silver system, and forms the external electrode. Since the burning temperature (before or after about 600 degrees C) of a conductive paste was close to the burning temperature (before or after about 620 degrees C) of the glass used as an insulating layer, silver was spread in the glass insulating layer on the occasion of baking of conductive paste, and there was a fault of degrading electric insulation especially in a humidity ambient atmosphere. Moreover, in the baking process of a conductive paste, there was a fault that heat stress joined a glass insulating layer and a crack entered into glass, from the difference in thermal-expansion contraction of a glass insulating layer and a conductive paste. Moreover, when forming a glass insulating layer, there was a fault that a man day started very much.

[0004]The purpose of this invention reduces the man day which starts in order to form the glass insulating layer which constituted the conventional electrostrictive effect component, and is to offer the electrostrictive effect component which can prevent degradation and the heat stress in process of

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electric insulation.

[0005]

[Means for Solving the Problem]In the laminating mold electrostrictive effect component which carried out the laminating of a piezo-electric ceramic member and the internal electrode conductor layer by turns, the laminating mold electrostrictive effect component of this invention has a pressurization conductivity film on the side face of the pair which said electrostrictive effect component counters, and it constitutes as a description that pressurization connection of said pressurization conductivity film is moreover alternately made on each side face setting further on said internal electrode outcrop end face.

[0006]

[Example]Next, this invention is explained with reference to a drawing. Drawing 1 is the sectional view of the electrostrictive effect component of one example of this invention.

[0007]This electrostrictive effect component 100 is piezo-electric ceramic member 3a1 -3an-1. It is internal electrode conductor-layer 4b1 -4bn in between. The layered product piled up by turns, internal electrode conductor-layer 4b1 -4bn each eye [odd number] and even-numbered side-face convex section forms -- **** -- carrying out -- an external gear-tooth-like electrode -- a conductor 5c1 and 5c2 The pressurization conductivity film two e1 inserted between each, and two e2 It is contained and constituted.

[0008]The pressurization conductivity film two e1 and two e2 Unlike the different directivity electric conduction film in which conductivity is only merely shown between the front flesh sides of a film, in the usual condition, although it is an insulator, when a pressure is applied, there is the description which shows conductivity in the part and the direction in which the pressure was added. (For example, trade name Z LINKEM of a shall company etc.) The electrostrictive effect component 100 of this exampleMix the powder of an organic binder (for example, polyvinyl butyral resin) to the powder (for example, Pb(Zr, Ti) O3) of a multicomponent solid-solution ceramic which has the perovskite crystal structure first, and a green sheet is made. After carrying out printing spreading of the silver-palladium paste besides, a 50-80-layer laminating is carried out, and a laminating sintered compact is formed by performing elevated-temperature sintering (for example, 1,000 degrees C or more).

[0009]Next, internal electrode conductor-layer 4b1 -4bn exposed to the side face in which this laminating sintered compact counters It sets on one side face inside. four b2 and four b4 --4bn the external electrode manufactured by etching in the configuration shown in an end face at drawing 2 (a) and (b) -- conductor (for example, copper alloy) 5c2 heights -- said internal electrode layer four b2 and four b4 --4bn It positions according to a top. Pressurization conductivity film five e2 Pressurization connection is minded and made.

[0010]then, another side face -- setting -- four b1 and four b3 --4bn-1 a top -- the same -- carrying out -- an external electrode -- conductor 5c1 Pressurization conductivity film two e1 Pressurization connection is minded and made. Therefore, on both sides of the projection which is pressurizing the film, and a film, it will connect electrically between a projection and the internal electrode conductor layer which counters.

[0011]the first example of the above -- an external electrode -- a conductor 5c1 and 5c2 Although etching was used as a means to manufacture, it can manufacture similarly by cutting (a dicing saw is used).

[0012]the external electrode which was mentioned above and which carried out cutting -- a conductor has the advantage that it is processible according to between the layers of an internal electrode conductor layer compared with what was manufactured by etching.

[0013]in addition, an external sinking comb-like electrode -- a conductor can also be manufactured by dividing into two like drawing 3

[0014]

[Effect of the Invention]the internal electrode conductor layer exposed to the

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side face in which this invention counters instead of a glass insulating layer as explained above -- respectively -- ** -- the external electrode of the shape of a sinking comb of a pair processed so that it might connect electrically to set further with alternation -- a conductor. Since the sinking comb-like internal electrode conductor layer was formed by making pressurization connection through a pressurization conductivity film in each side face. The cause which leads to degradation of insulation that silver is spread in glass at the time of external electrode conductor-layer formation, or a crack occurs in glass by heat stress can be abolished, and the dependability of an insulating layer becomes high as a result, and it has the effectiveness that degradation of a component can be prevented.

[0015] Moreover, it is not necessary to form a glass insulating layer, since a process can be shortened, a man day can be reduced, and it also has the effectiveness that the cost of a product falls.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the electrostrictive effect component of one example of this invention.

[Drawing 2] the external electrode used for one example of this invention shown in drawing 1 -- it is the side elevation and top view of a conductor.

[Drawing 3] the external electrode used for other examples of this invention -- it is the top view showing the structure of a conductor.

[Drawing 4] It is the perspective view of an example of the conventional electrostrictive effect component.

[Description of Notations]

Two e1, two e2 Pressurization conductivity film

Three a1, 3a2 -3an+1 Piezo-electric ceramic member

Four b1, 4b2 -4bn Internal electrode conductor layer

5c1 and 5c2 an external electrode -- conductor

5 External Electrode Conductor Layer

6d1, 6d2 Lead wire

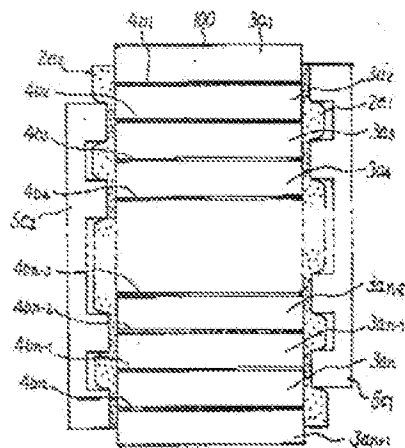
7i1, 7i2 Glass insulating layer

100,110 Electrostrictive effect component

DRAWINGS

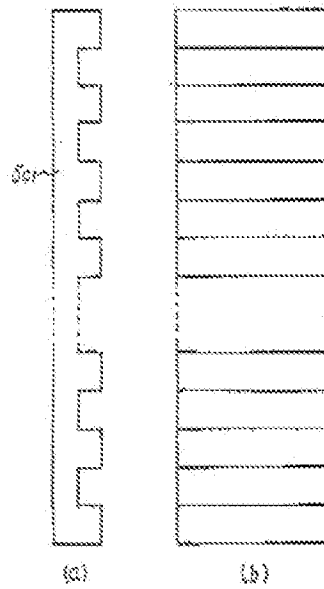
[Drawing 1]

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[Drawing 2]



301: 外部電極層

[Drawing 3]

